Virtual/E-Learning Education and its Correlation to Childhood Obesity Rates & Vision Problems during the COVID-19 ERA in Government School, Fujairah: Retrospective Observational Study

Fatmah Alkaabi[1], Fatmah Alabdouli[2*], Himadree Pattanaik[2], Lyka Zantua[2] and Maryam Ali[1]

[1]*Al Faseel Family Health & Promotion Centre, United Arab Emirates*

[2]*Nursing Department, Primary Health Care Centre, United Arab Emirates*

*****Corresponding Author**
Fatmah Alabdouli, Nursing Department, Primary Health Care Centre, Community Health, United Arab Emirates.

Abstract

Background: The coronavirus disease 2019 (Covid-19) pandemic is causing substantial morbidity and mortality, straining health care systems, shutting down economies, and closing school districts. While it is a priority to mitigate its immediate impact, we want to call attention to the pandemic's longer-term effect on children's health; Covid-19, via these school closures, may exacerbate the epidemic of childhood obesity and increase disparities in obesity risk and vision impairment. Increasing evidence demonstrates a strong correlation between obesity and the Covid-19 disease.

Objective: The emergence of the coronavirus disease has forced governments worldwide to implement non-pharmaceutical interventions that imposed strict confinement policies on their populations, including children and adolescents. Subsequently, the education system has shifted from traditional to online classroom settings, introducing physical and lifestyle changes in students. This study aimed to determine the impacts of virtual/e-learning education on body mass index, obesity, and visual acuity during Covid-19 outbreak (BMI & visual acuity score just before the time of pandemic i.e. pre-closing with that of re-opening of schools between the times 2019-2020 to 2021-2022. Apart of this, the second & third aim was to compare the variables, and find out the association between BMI & visual acuity with their social demographic variable between pre-closing with school re-opening period during pandemic related to virtual/e-learning.

Materials and Methods: We included all original research articles in Covid-19, school student; obesity & based on classification of Body Mass Index (BMI) and visual acuity. The Study was a retrospective observational study conducted at the School Health Department Fujairah under Primary Health Care between December 2019 and December 2021 & carried out students' data from the school health department's statistical health record; approximate n=9230 (height, weight, BMI & visual acuity) between ages 5 and 18 from school. Among them some of was having obesity & visual acuity, who attended school before the pandemic (2019-20). Due to pandemic during the virtual study period, students were all at their homes because their school program was suspended. The schools were closed during the period of December 2019 to May 2021. The demographic variable was taken as age, sex, level of school cycle (cycle-1, 2 & 3) & duration of e-learning with electronic devices (Laptop, iPad, and mobile). Body mass index (BMI) was determined using the Centre for Disease Control and Prevention standards.

Result: In total 9980 sample was taken from that, 325 were removed as due to mismatch in the paired data & during analysis to discrepancy. So, 9230 samples, 425 data were excluded due were considered as eligible for the study. Age range was between 5 and 18 years with a mean age being 11.5 years. BMI percentiles as well as vision acuity were calculated, totalled and compared between pre-school closing and school closing period. Paired t-test was done. p value\0.001 was considered statistically significant. Study revealed significant differences in variables such as body weight, body mass index before and

after lockdown. Post-lockdown, the mean body mass index (BMI) increased among all participants from 18.1 to 24.6 kg/m2 (p<0.001) the same time visual acuity ranges from 8.2 to 10.3%. Researchers hypothesized that Gender has no association with students BMI or visual acuity (p<0.001), so null hypothesis is accepted. There is no difference between pre-pandemic & during pandemic between gender with BMI or visual acuity.

Conclusion: *Covid-19 places children at increased risk for physical and psychosocial sequelae. For schools that have the capacity to stream online classes, physical education teachers could stream exercise classes and a few exercise programs could be adapted into at-home lesson plans to engage children in physical activity. A supportive relationship with adults will help "buffer" a stressful experience and support the child's adaptation. Ensuring the health of children, especially those with the chronic condition of childhood obesity, requires ongoing monitoring by healthcare specialists. Healthcare and educational systems should engage in an adequate supporting and managing system to deal with childhood obesity. Educating the parents on food availability, convenience, and how to choose food wisely even if on a budget, is an issue that needs to be tackled. Advocacy for physical activity while maintaining social distancing is necessary. BMI, obesity, and overweight increase among children during the Covid-19 lockdown, disproportionately affecting disadvantaged subpopulations. Strategies are needed to counteract the impact of the Covid-19 lockdown on unhealthy weight gain and childhood obesity. As Children are spending more, time indoors using electronic media for both education and recreation. Watching TV, playing computer games and using tablets or smartphones increased screen time. In conclusion, home education during the Covid-19 pandemic will have the chance of increase the myopia progression rate in children. It is important to know the impact on the children's Quality of Life (QOL) to address childhood obesity, as well as vision acuity, which if neglected may lead to long-term profound complications of higher eminence than the actual Covid-19 infection. The prevention and management of childhood obesity, vision acuity, should be set as a priority at an individual, community and population level during this pandemic.*

1. Introduction

1.1. Background of the Study

The coronavirus disease 2019 (Covid-19) pandemic is causing substantial morbidity and mortality, straining health care systems, shutting down economies, and closing school districts. While it is a priority to mitigate its immediate impact, we want to call attention to the pandemic's longer-term effect on children's health; Covid-19, via these school closures, may exacerbate the epidemic of childhood obesity and increase disparities in obesity risk and vision impairment [1].

It is important to pay attention to the indirect effects of the Covid-19 pandemic on children and adolescents' health caused by a compulsory sedentary lifestyle. It is reported that there were decreased physical activity and weight gain in 56.7% of school-aged children and adolescents in the Republic of Korea during the Covid-19 pandemic [2]. The school closing due to the Covid-19 pandemic may reduce physical activity aggravate obesity and increase the risk of other metabolic diseases in the paediatric population [3]. However, there are scarce data on the impact of Covid-19 related school closing on paediatric health. Obesity occurs as the result of interactions between genetic and environmental factors; however, school and out-of-school environments related to decrease physical activity are factors that may contribute to paediatric obesity in school-aged children. Von Hippel et al [4].

Covid-19 is a highly contagious disease in humans causing significant rates of illness, hospitalization, and death. World Health Organization declared Covid-19 a pandemic on March 11, 2020. Pandemic is causing substantial morbidity and mortality,

straining health care systems, shutting down economies, and closing school districts [5]. Even with the implementation of major interventions to contain the spread of the disease, Covid-19 has progressed worldwide resulting in significant morbidity and mortality [6]. To control the spread of Covid-19 infection, many restrictions have been imposed on school-going children including school closures all across the world. As a result, education has changed dramatically, with the distinctive rise of E-learning, whereby teaching is undertaken remotely and on digital platforms with the help of electronic resources. Children are spending more time indoors using electronic media both for education and for recreation [7].

During the pandemic's long months of stay-at-home orders and limited activities; the coronavirus pandemic protracted disruption of in-person schooling, sports, and other activities leading to obesity that could have a long-lasting impact on children's health. Children are snacking more, exercising less. Their increased screen time, sedentary lifestyle, and inadequate sleep, anticipated weight gain during lockdown that could lead to complications [8].

For future plans, if any pandemic event, one study research Abrams L said that, for schools that have the capacity to stream online classes, physical education teachers could stream exercise classes and a few exercise programs could be adapted into at-home lesson plans to engage children in physical activity [9]. Ensuring the health of children, especially those with the chronic condition of childhood obesity, requires ongoing monitoring by healthcare specialists. Healthcare and educational systems should engage in an adequate supporting and managing system to deal with childhood obesity. Educating the parents on food availability,

convenience, and how to choose food wisely even if on a budget, is an issue that needs to be tackled. Advocacy for physical activity while maintaining social distancing is necessary [9].

2. Material and Methods
2.1. Study Design
Study was done on, children in & around UAE (Fujairah) government school this retrospective Cohort. Data was collected from School Health (Fujairah) statistical department. The MOHAP research ethical committee approved this study.

2.2. Subjects
It was assumed that school closing period was from December 2019 to May 2021. Before the pandemic, the school health administration also gives prioritized to maintain a good life style among students & to reduce the risk of obesity & its complication in Fujairah. So yearly in the first semester started to monitor the student BMI status of the students through obesity statistics & customer service from each school by the school health nurse. In this also the school health nurse joined with PE teacher to do follow up & if needed then ask for advice from dietician to reduce the overweight which is going to fall with obesity. In between, this period pandemic started in 2019; all school was closed for student's safety. So, student's active life style was hampered as well as watching electrical device was increased, so life style became changed from active to sedentary. Therefore, it was need to know how much severity this pandemic gave bad impact after

started these virtual learning methods. The student data was contained following domains: demographic details, Children's characteristics; Height of child in centimetres (cms), Weight in Kilograms (kgs) before lockdown and after lockdown, with the visual acuity for normal & abnormal data. The total population size for this study was 24533, taken as per the inclusion criteria in between the age group 5 to 18 years of age & all studied under Government school Fujairah C1, C2 & C3 cycle. Those who are less than 5 years & above than 18 years with KG student were excluded from the study. The research was a sample-based study & sample size was calculated through Survey monkey calculator with 99% confidence level & margin error 1%. 9655 were eligible for final analysis. However, to avoid data error 327 students were excluded in this study as some students were transferred to other emirates, some went to private schools & some went to other country for treatment purpose & during analysis, 425 data were excluded due to discrepancy. So 9230 samples were considered as eligible for the study.

2.3. Primary Predictors
Virtual/e-learning due to COVID-19 pandemic has had a substantial negative impact on the health in school students with obesity and visual acuity. COVID-19 lockdown, the children's frequencies of their physical activities have reduced, and their sedentary, sleeping, and screen time have all increased. Obesity was defined by BMI, calculated as weight (kilograms/height2 (meters) based on the Disease Control and Prevention (CDC).
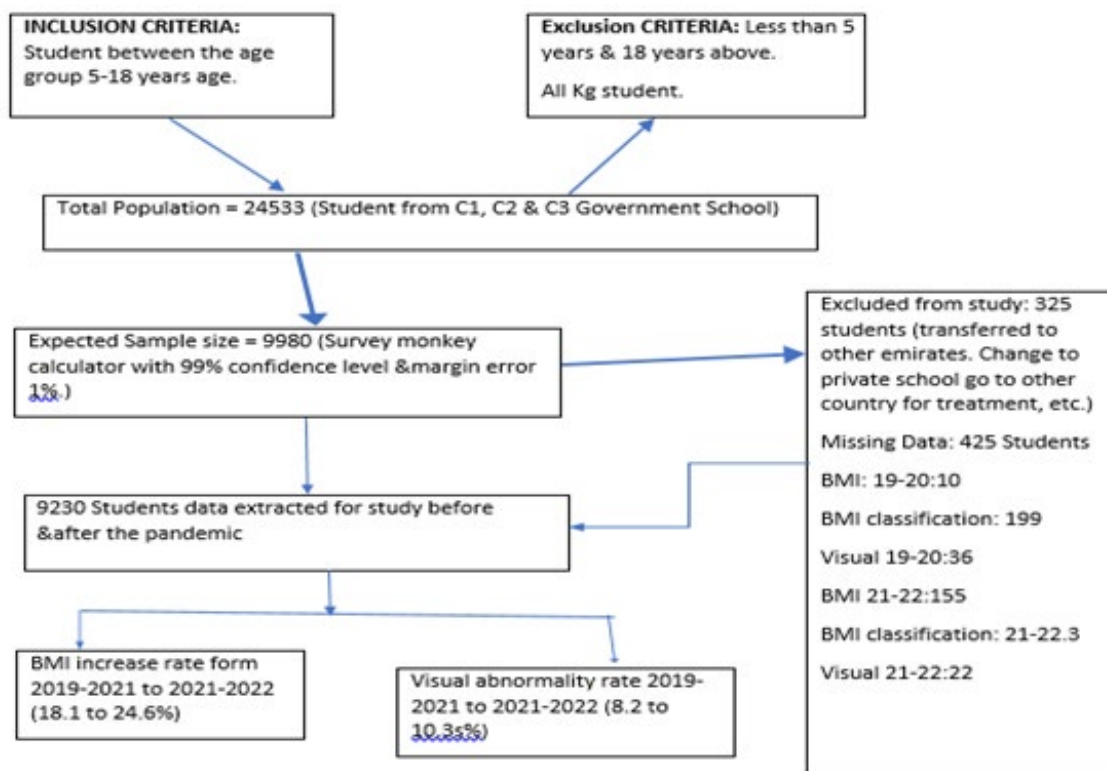

Figure 1: Study Population Criteria Cohort was divided into Groups based off BMI (Body Mass Index) as well as Visual Acuity

2.4. Statistical Analysis

According to CDC, Obesity is defined if the BMI percentile derived from the CDC's sex and age specific growth chart is at or above the 95th percentile. At risk for overweight is defined if the BMI percentile is at or above the 85th percentile, but less than the 95th percentile of BMI. For Standard Vision acuity test it was measured by Snellen chart, considered as 6/6 as normal vision, alteration of that considered as abnormal. Data tabulation was done using MS Excel 2013 and SPSSv22 used to evaluate data. Data tabulation was done using MS Excel & SPSSv22. Continuous data was given as mean ± standard deviation, categorical data was given as number (percent). Paired t -test was computed to assess significant changes in BMI before and after the lockdown period. Statistical evaluation was done using IBM SPSS statistics for Windows v26 (Armonk NY: IBM Corp). P value<0.001 was considered statistically significant.

3. Results

Compare the variables between pre-school closing with school closing period during pandemic related to virtual/e-learning

Demographic Details (n)		No.	%
Gender	Female	4973	53.9
	Male	4257	46.1

Table 1: Frequency and Percentage of Demographic Details n = 9230
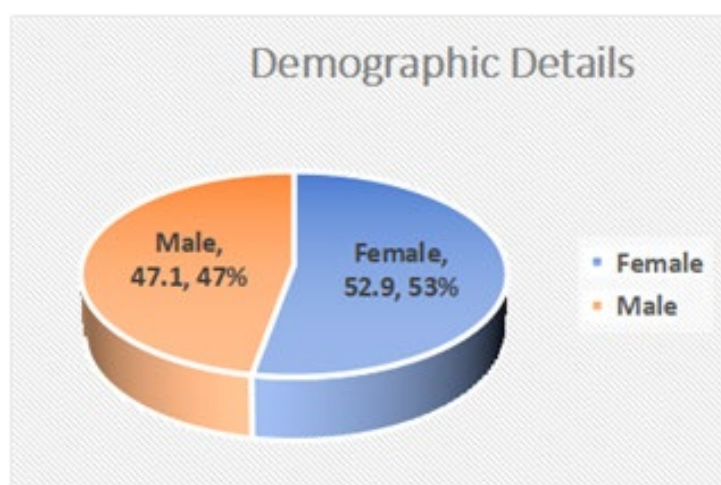

Figure 2: (Pie-Chart) Frequency and Percentage of Demographic Data of Study Participants

Sample size was 9230(n). Demographic data noted (Table 1). Table 1 presents the characteristics of the child participants. n = 9230, of which 4973 (53.9%) were females and 4257 (46.1%) were males.

Overall female: male ratio was 1.16:1. Age-wise and gender-wise distribution across groups depicted in Figure 1. Age range was between 5 and 18 years with mean age 11.5 years.

BMI	2019-2020		2021-2022	
	No.	%	No.	%
Thinner/severe thinner/wasted	187	2.0	162	1.8
Under Weight (<5thpercentile)	505	5.5	249	2.7
Normal (>5th to<85th percentile)	5636	61.1	5082	55.1
Over Weight(>85thto<95thpercentile)	1233	13.4	1471	15.9
Obese (>/ 95thpercentile)	1669	18.1	2266	24.6
Total	9230	100	9230	100

Table 2: Changes in BMI, Obesity and Overweight Before and After the Covid-19 Pandemic Lockdown among Participants

Table 2 shows the classification of BMI according to CDC growth charts. 61.1% of the study population is between the 5th and 85th percentile which, according to the CDC growth charts, comes under the healthy weight category shown a variable change to 55.1% during pandemic whereas those who are between 85 and 95th percentile (at risk of being obese) varied from 13.4 to 15.9% shown gradually increased in the parameter. At last, the study population with BMI percentile equal to or greater than the 95th percentile (which indicates that they are obese) spiked from 18.1 to 24.6%. Table-3, shown the overall differences between overweight & Obese before & during the pandemic.

BMI Classification	2019-2020		2021-2022	
	No.	%	No.	%
Overweight and Obese	2902	31.5	3737	40.5
Total	9230	100	9230	100

Table 3: Changes in BMI, Obesity and Overweight Before and After the Covid-19 Pandemic Lockdown among Participants
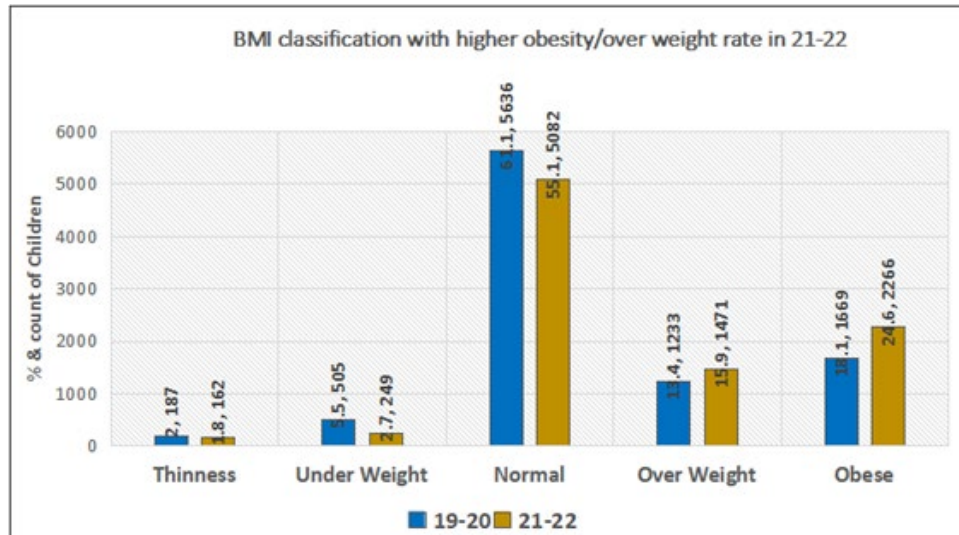

Figure 3: BMI Classification with Higher Obesity/Overweight Rate in 21-22

Visual Classification	2019-2020		2021-2022	
	No.	%	No.	%
Normal	8472	91.8	8276	89.7
Abnormal	758	8.2	954	10.3
Total	9230	100.0	9230	100.0

Table 4: Changes in Visual Acuity Before and After the Covid-19 Pandemic Lockdown among Participants

From Table 4, it was found that there is 2.1% of increase in visual abnormality from the base period of 19-20 to 21-22, which can be attributed to the impact of virtual education during the pandemic.
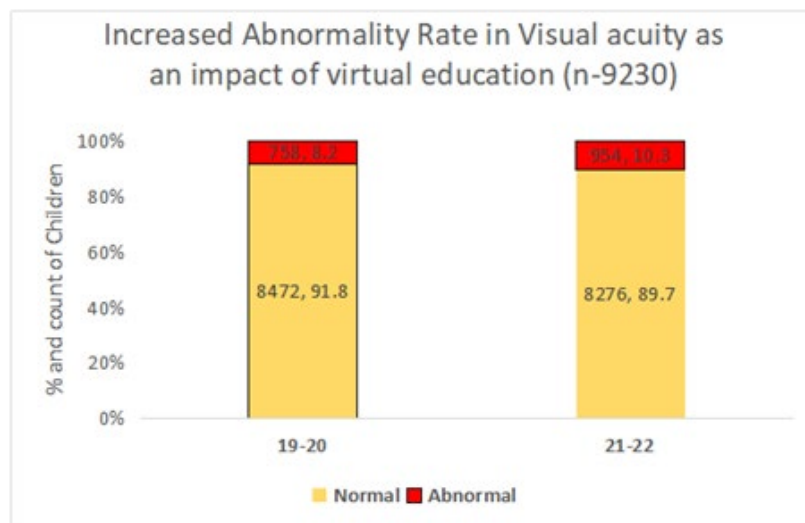

Figure 4: Increased Abnormality Rate in Visual Acuity as an Impact of Virtual Education

Figure 4 shown the classification of normal vs abnormal visual acuity between the period, normal acuity decreased the percentage from 91.8 to 89.7, whereas there was spiked of abnormality from 8.2 to 10.3.

Descriptive Statistics		BMI 19-20	BMI 21-22
Mean		19.73	21.65
95% Confidence Interval for Mean	Lower Bound	19.61	21.52
	Upper Bound	19.86	21.79
Std. Deviation		6.18	6.70
Median		17.80	20.10
Interquartile Range (IQR)		7.50	8.40
Total (n)		9230	9230
p-value (by Wilcoxon Signed rank test)		<0.0 01	

Table 5: Impacts of Virtual/E-Learning on Body Mass Index, Obesity, and Visual Acuity in Covid19 Outbreak during Closing Schools

BMI (n-9230)	Percentiles						
	5	10	25	50	75	90	95
BMI19-20	13.3	13.9	15.2	17.8	22.7	28.5	32.2
BMI21-22	14.0	14.7	16.7	20.1	25.1	30.8	34.9

Table 6: Changes in BMI, Obesity and Overweight Before and After the Covid-19 Lockdown Period is shown in Table 2.

From Table 5 & Table 6, inferential statistics shown that, Post-lockdown, the mean body mass index (BMI) increased among all participants from 19.73 to 21.65 kg/m2 (p<0.001). The overall obesity (18.1 –24.6%, p<0.001) and overweight (13.4 –15.9%, p<0.001) burdens significantly increased after the lockdown period.

There is only minor difference in the BMI level from 2019-2020 to 2021-2022 (9.8% of increase in BMI), but it is statistically significant due to the larger sample size (large sample fallacy is evident in the inferential results. It is one of the limitations of this study. However, precision is higher in the estimates at larger sample). Virtual/E-learning education has an impact on the BMI level and virtual education system increases students BMI level. BMI rate shows an upward trend, significantly increased from 17.8 to 20.1 in the year 2021-22. Percentile shows that 25% of the BMI values are above 25.1 in the year 21-22.

3.1. Impacts of Virtual/E-Learning on Visual Acuity
McNemar's statistical test has been used to find the impact of virtual education on students' Visual acuity. Since Visual acuity is a paired nominal data, McNemar test is the suitable inferential technique. It measures repeatedly before and after virtual education. McNemer's test was used to test whether this difference identified in the sample is statistically significant in the population or not.

			Visual acuity classification 21-22		Total
			Normal	Abnormal	
Visual acuity classification 19-20	Normal	No.	8072	400	8472
		%	95.3%	4.7%	100.0%
	Abnormal	No.	204	554	758
		%	26.9%	73.1%	100.0%
Total		No.	8276	954	9230
		%	89.7%	10.3%	100.0%

Table 7: McNamar's Test Results in The Year 2019-2020, 400 (4.7%) Children were noticed with Normal Visual Acuity, Had Abnormality in the Year 2021-2022

Table 7 shows the Virtual education has a significant effect on their visual acuity (by McNemers test, p value <0.001),% of increase in the visual abnormality rate is found to be real in the population as well. Same trend identified in the case of BMI, using McNemers test. % of Difference is statically significant with p value <0.001

			Thinness	Under Weight	Normal	Over Weight	Obese
					BMIclass2122_code		
BMI1920Code	Thinness	Count	95	3	80	5	4
		%	50.8%	1.6%	42.8%	2.7%	2.1%
	Under Weight	Count	9	113	339	26	18
		%	1.8%	22.4%	67.1%	5.1%	3.6%
	Normal	Count	52	129	4251	753	451
		%	0.9%	2.3%	75.4%	13.4%	8.0%
	Over Weight	Count	4	3	302	485	439
		%	0.3%	0.2%	24.5%	39.3%	35.6%
	Obese	Count	2	1	110	202	1354
		%	0.1%	0.1%	6.6%	12.1%	81.1%
Total		Count	162	249	5082	1471	2266
		% within BMI1920Code	1.8%	2.7%	55.1%	15.9%	24.6%

BMI classification 19-20		Visual acuity Classification 19-20		Total	p value
		Normal	Abnormal		
Thinner/severe thinner/wasted	Count	166	21	187	
	%	88.8%	11.2%	100.0%	
Under Weight	Count	458	47	505	
	%	90.7%	9.3%	100.0%	
Normal	Count	5238	398	5636	<0.001 (limitation - large sample effect)
	%	92.9%	7.1%	100.0%	
Over Weight	Count	1111	122	1233	
	%	90.1%	9.9%	100.0%	
Obese	Count	1499	170	1669	
	%	89.8%	10.2%	100.0%	
Total	Count	8472	758	9230	
	%	91.8%	8.2%	100.0%	

Table 8: Association between BMI & Visual Acuity with their Social Demographic Variable in the School Closing Period During the Pandemic 2019-20

From Table 8, we found though there is an inconsistent trend, Visual Abnormality rate is slightly increasing when BMI abnormality increases (by Pearson's Chi-square test) Visual abnormality increases from 9.9% to 10.2% when BMI increases from overweight to obese category, and the rate of increase found to be statically significant. however, the % of increase is not that high in the year 2019-20.

BMI classification 21-22		Visual Classification 21-22		Total	p value
		Normal	Abnormal		
Thinner/severe thinner/wasted	Count	148	14	162	
	%	91.4%	8.6%	100.0%	
Under Weight	Count	227	22	249	
	%	91.2%	8.8%	100.0%	
Normal	Count	4596	486	5082	0.034 <0.05 (significant)
	%	90.4%	9.6%	100.0%	
Over Weight	Count	1300	171	1471	
	%	88.4%	11.6%	100.0%	
Obese	Count	2005	261	2266	
	%	88.5%	11.5%	100.0%	
Total	Count	8276	954	9230	
	%	89.7%	10.3%	100.0%	

Table 9: Association between BMI & Visual Acuity with their Social Demographic Variable in the School Closing Period during the Pandemic 2021-22

Gender Code				VisualClass1920_Code		Total
				Normal	Abnormal	
Female	BMI1920Code	Thinner/severe thinner/wasted	Count	148	20	168
			%	88.1%	11.9%	100.0%
		Under Weight	Count	226	17	243
			%	93.0%	7.0%	100.0%
		Normal	Count	2756	254	3010
			%	91.6%	8.4%	100.0%
		Over Weight	Count	682	83	765
			%	89.2%	10.8%	100.0%
		Obese	Count	703	84	787
			%	89.3%	10.7%	100.0%
	Total		Count	4515	458	4973
			%	90.8%	9.2%	100.0%
Male	BMI1920Code	Thinner/severe thinner/wasted	Count	18	1	19
			%	94.7%	5.3%	100.0%
		Under Weight	Count	232	30	262
			%	88.5%	11.5%	100.0%
		Normal	Count	2482	144	2626
			%	94.5%	5.5%	100.0%
		Over Weight	Count	429	39	468
			%	91.7%	8.3%	100.0%
		Obese	Count	796	86	882
			%	90.2%	9.8%	100.0%
	Total		Count	3957	300	4257
			%	93.0%	7.0%	100.0%

Table 10: Association with Gender with BMI in Pandemic Period 2019-2020

Table 10 shown that, among the females, though there is a steady increase in the visual abnormality rate; it does not show statically significance in the population. Implies, the 5 of increase is just by chance. Whereas in the males, the difference in the percentage from 5.5 to 9.8 is statistically significant.

Gender Code				Visual Class2122 Code		Total
				Normal	Abnormal	
Female	BMIclass2122_Code	Thinner/severe thinner/wasted	Count	120	13	133
			%	90.2%	9.8%	100.0%
		Under Weight	Count	106	11	117
			%	90.6%	9.4%	100.0%
		Normal	Count	2477	316	2793
			%	88.7%	11.3%	100.0%
		Over Weight	Count	770	108	878
			%	87.7%	12.3%	100.0%
		Obese	Count	894	158	1052
			%	85.0%	15.0%	100.0%
	Total		Count	4367	606	4973
			%	87.8%	12.2%	100.0%
Male	BMI1920Code	Thinner/severe thinner/wasted	Count	28	1	29
			%	96.6%	3.4%	100.0%
		Under Weight	Count	121	11	132
			%	91.7%	8.3%	100.0%
		Normal	Count	2119	170	2289
			%	92.6%	7.4%	100.0%
		Over Weight	Count	530	63	593
			%	89.4%	10.6%	100.0%
		Obese	Count	1111	103	1214
			%	91.5%	8.5%	100.0%
	Total		Count	3909	348	4257
			%	91.8%	8.2%	100.0%

Table 11: Association with Gender with BMI in Pandemic Period 2021-2022

In Table 11, when it compared to males, females are more prone to increased abnormality for higher BMI. In 2021-2022, the percentage of female increased from 9.4 to 15 with obese, the same in male increased from 8.3 to 10.6. This result was found statistically significant.

4. Discussion

The coronavirus disease 2019 (Covid-19) pandemic is causing substantial morbidity and mortality, straining health care systems, shutting down economies, and closing school districts. While it is a priority to mitigate its immediate impact, we want to call attention to the pandemic's longer-term effect on children's health due to virtual learning, Covid-19, via these school closures, may exacerbate the epidemic of childhood obesity and increase disparities in obesity risk as well visual acuity.

In this study, the results show that Virtual/e-learning due to Covid-19 pandemic has had a substantial negative impact on the health in school students with obesity and visual acuity which were statistically significant (p<0.001). We found that, after the Covid-19 lockdown, the children's weight status & abnormal visual acuity has increased; the frequencies of their physical activities have reduced, and their sedentary, sleeping, and screen time have all increased. The COVID related pandemic has led to a sharp increase in our students' screen time, owing to virtual education, online entertainment, gaming video chatting with friends etc. "Screen time" refers to the duration of time spent by an individual in activities that involve peering at a digital screen. This pandemic has given rise to another pandemic of eye related issues. The most important thing required to treat or avoid digital eyestrain is to establish a "good screen schedule". following 20-20-20 rule i.e., after every 20 minutes of screen time, taking a twenty second break and focusing eyes on something 20 feet away will not only reduce stress on eyes but also will keep individual active.

A study by conducted by Williams et al., on 3,320 children in the age-group of 5-18 years classified children as fat if their percentage of body fat was at least 25% for males and 30% for females,

respectively [10]. The Centre for Disease Control and Prevention defined over weight as at or above the 95th percentile of body mass index (BMI) for age and "at risk for overweight" as between 85 to 95th percentile of BMI for age [11,12]. European researchers classified overweight as at or above 85th percentile and obesity as at or above 95th percentile [13]. An Indian research study has defined overweight (between C 85th and \95th percentile) and obesity (C 95th percentile) [14]. Another study has followed World Health Organization 2007 growth reference for defining overweight and obesity [15].

The ecological model, as described by Davison et al., suggests that child risk factors for obesity include dietary intake, physical activity, and sedentary behaviour [16]. The impact of such risk factors is moderated by factors such as age, gender. Family characteristics parenting style, parents lifestyles also play a role. Eating out or watching TV while eating is associated with a higher intake of fat.

One of the factors that is most significantly linked to obesity is a sedentary lifestyle. Each additional hour of television/ learning by electronic device per day increased the prevalence of obesity by 2% (20). Prolonged use of electronic device (computer, tab) due to virtual learning viewing among young children and adolescents has increased dramatically in recent years [17,18]. The increased amount of time spent in sedentary behaviours has decreased the amount of time spent in physical activity. Research which indicates the number of hours children spend watching TV/Tab/Computer correlates with their consumption of the most advertised goods, including sweetened cereals, sweets, sweetened beverages, and salty snacks [19].

It was reported in one study in Copenhagen that online platforms were extensively used by the young generation to communicate with others, to play video games and to access social media prior to COVID-19 pandemic also [20]. However, the pandemic increased screen time for children as schools shifted to E-learning. Although this was beneficial for educational purposes, the increase in screen time can further exacerbate sedentary habits as well as increase the risks for anxiety, depression and inattention [21].

A study had shown association between increased body mass index (BMI) and body fat percentage as screen time increased [22]. This is similar to the Pellegrini et al., where on average, during the lockdown period, self-reported weight and BMI significantly increased by 1.51 kg (p\ 0.001 by t-test for paired samples) and 0.58 kg/m2 (p \0.001), respectively [23]. Similar results are seen in study reports of Kim et al., where mean body mass index (BMI) increased among all participants from 26.7 to 27.7 kg/m2 (p \0.001) [24].

Another study had shown association between screen time and increase in snacking and a consequent increase in weight [25,26]. In our study, the mean body mass index (BMI) increased among all participants 19.66 to 21.59 kg/m2 (p<0.001). The overall obesity

(18.2 –24.6%, p<0.001) and overweight (13.4 –16.1%, p<0.001) burdens significantly increased after the lockdown period.

Covid-19 restrictions have reduced many healthy food and physical activity options for children. Clinicians, families and communities must create and prioritize alternate, safe options. The many effects of the Covid-19 pandemic on childhood obesity must be considered in creating effective health policy going forward. However, virtual platforms have been used by some schools to organize physical activity classes for children to easily follow at home [27,28]. Such initiatives should continue and be more readily implemented during these COVID-19 times.

4.1. Strength & Limitations

The strengths of the study were its large sample size, which allows for an exploration of detailed obesity as well as visual acuity categories, comprehensive examination of a wide range of variables. Although our study did not reach the target sample size very nearly, the study was able to estimate the difference & effect of virtual learning on the student with good precision as reflected by the narrow close obtained in the results. Moreover, the study was able to test association between some demographic variable, as its sample size was very big. After pandemic, some students were absent due to various reason & we collected that data by their patient record system from PHCs, which may varied from accurate data.

Because of the pandemic situation, we did not interview the parents or did questionnaire, so we had taken the sample as from school health department Fujairah. So, some variables we could not analyse like homely activities, food pattern, eating habits, home exercises, screen time – viewing patterns, sleep pattern, nature of family (nuclear / join) etc. So, this one also was a big limitation. Because these factors other than E-learning should be adjusted during analysis, to identify the individual effect of E-learning on BMI and visual acuity. Research was also only implemented in one of the seven Emirates, which limits the ability to generalize the results of the study. Collecting the data from the nurses in schools, in which there was some duplication & repetition.

5. Conclusion

Covid-19 places children at increased risk for physical and psychosocial sequelae. For schools that have the capacity to stream online classes, physical education teachers could stream exercise classes and few exercise programs could be adapted into at-home lesson plans to engage children in physical activity. A supportive relationship with adults can help "buffer" a stressful experience and support the child's adaptation. Ensuring the health of children, especially those with the chronic condition of childhood obesity, requires ongoing monitoring by healthcare specialists. Healthcare and educational systems should engage in an adequate supporting and managing system to deal with childhood obesity. Educating the parents on food availability, convenience and how to choose food wisely even if on a budget, is an issue that needs to be tackled. BMI, obesity and overweight increased among children

during the COVID-19 lockdown, disproportionately affecting disadvantaged subpopulations. Strategies are needed to counteract the impact of the Covid-19 lockdown on unhealthy weight gain and childhood obesity. Impaired ocular health due to increased screen time cannot only lead to dryness in the eyes but also myopia progression, which may be accelerated due to rubbing of eyes as well. However, current generation is fortunate enough to have these connecting devices and technologies at hand, but one should also be smart enough to use them judiciously and not be their slaves. It is for the parents to give clear instructions regarding duration of screen time and abide by them, use parental controls and utilize this lockdown to encourage communication and build a healthy relationship between them and their children [29].

Consent for Publication
The authors declare that this manuscript is original, has not been published before and is not currently being considered for publication.

Author Contribution
Principal Investigator: Assessed, designing the study protocol, conducting the search & co-operate the Co-investigators as well as communicate with the research committee.

Co-Investigator: Investigate the whole research process; data collection, data management, interpreting results, drafting and revising the article, conducted the analyses, contributed to the design of the study, interpreting results and revision of the article. All authors read and approved the final paper.

References
1. Kohut, T., Robbins, J., & Panganiban, J. (2019). Update on childhood/adolescent obesity and its sequela. Current Opinion in Pediatrics, 31(5), 645-653.
2. Agarwal, S., Bhartiya, S., Mithal, K., Shukla, P., & Dabas, G. (2021). Increase in ocular problems during COVID-19 pandemic in school going children-a survey based study. Indian journal of ophthalmology, 69(3), 777.
3. Gurnani, M., Birken, C., & Hamilton, J. (2015). Childhood obesity: causes, consequences, and management. Pediatric Clinics, 62(4), 821-840.
4. Von Hippel, P. T., Powell, B., Downey, D. B., & Rowland, N. J. (2007). The effect of school on overweight in childhood: gain in body mass index during the school year and during summer vacation. American journal of public health, 97(4), 696-702.
5. Kim, E. S., Kwon, Y., Choe, Y. H., & Kim, M. J. (2021). COVID-19-related school closing aggravate obesity and glucose intolerance in pediatric patients with obesity. Scientific reports, 11(1), 5494.
6. WHO Director-General's opening remarks at the media briefing on COVID19—11 March 2020.
7. Rundle, A. G., Park, Y., Herbstman, J. B., Kinsey, E. W., & Wang, Y. C. COVID-19–Related school closings and risk of weight gain among children. Obesity. 2020; 28 (6): 1008–1009.
8. Gatto, M., Bertuzzo, E., Mari, L., Miccoli, S., Carraro, L., Casagrandi, R., & Rinaldo, A. (2020). Spread and dynamics of the COVID-19 epidemic in Italy: Effects of emergency containment measures. Proceedings of the National Academy of Sciences, 117(19), 10484-10491.
9. Abrams L. How to keep computer screens from destroying your eyes [Internet]. The Atlantic. 2020.
10. Williams, D. P., Going, S. B., Lohman, T. G., Harsha, D. W., Srinivasan, S. R., Webber, L. S., & Berenson, G. S. (1992). Body fatness and risk for elevated blood pressure, total cholesterol, and serum lipoprotein ratios in children and adolescents. American journal of public health, 82(3), 358-363.
11. Flegal, K. M., Wei, R., & Ogden, C. (2002). Weight-for-stature compared with body mass index–for-age growth charts for the United States from the Centers for Disease Control and Prevention. The American journal of clinical nutrition, 75(4), 761-766.
12. Himes, J. H., & Dietz, W. H. (1994). Guidelines for overweight in adolescent preventive services: recommendations from an expert committee. The American journal of clinical nutrition, 59(2), 307-316.
13. Ghosh, A. (2014). Explaining overweight and obesity in children and adolescents of Asian Indian origin: the Calcutta childhood obesity study. Indian journal of public health, 58(2), 125.
14. Nawab, T., Khan, Z., Khan, I. M., & Ansari, M. A. (2014). Influence of behavioral determinants on the prevalence of overweight and obesity among school going adolescents of Aligarh. Indian journal of public health, 58(2), 121.
15. Flodmark, C. E., Lissau, I., Moreno, L. A., Pietrobelli, A., & Widhalm, K. (2004). New insights into the field of children and adolescents' obesity: the European perspective. International journal of obesity, 28(10), 1189-1196.
16. Davison, K. K., & Birch, L. L. (2001). Childhood overweight: a contextual model and recommendations for future research. Obesity reviews, 2(3), 159-171.
17. Anderson, P. M., & Butcher, K. F. (2006). Childhood obesity: trends and potential causes. The Future of children, 19-45.
18. Story, M., Neumark-Sztainer, D., & French, S. (2002). Individual and environmental influences on adolescent eating behaviors. Journal of the American Dietetic association, 102(3), S40-S51.
19. Kapil, U., & Bhadoria, A. S. (2014). Television viewing and overweight and obesity amongst children. Biomed J, 37(5), 337-8.
20. Inchley J, Currie D, Budisavljevic S, Torsheim T, Ja˚stad A, Cosma A et al (2020) Spotlight on adolescent health and

wellbeing. In: Findings from the 2017/2018 health behaviour in school-aged children (HBSC) survey in Europe and Canada. International report, vol 1. Key findings. Copenhagen, pp 1–2

21. Nagata, J. M., Magid, H. S. A., & Gabriel, K. P. (2020). Screen time for children and adolescents during the coronavirus disease 2019 pandemic. Obesity (Silver Spring, Md.), 28(9), 1582.

22. Tripathi, M., & Mishra, S. K. (2020). Screen time and adiposity among children and adolescents: a systematic review. Journal of Public Health, 28, 227-244.

23. Pellegrini, M., Ponzo, V., Rosato, R., Scumaci, E., Goitre, I., Benso, A., ... & Bo, S. (2020). Changes in weight and nutritional habits in adults with obesity during the "lockdown" period caused by the COVID-19 virus emergency. Nutrients, 12(7), 2016.

24. Kim, E. S., Kwon, Y., Choe, Y. H., & Kim, M. J. (2021). COVID-19-related school closing aggravate obesity and glucose intolerance in pediatric patients with obesity. Scientific reports, 11(1), 5494.

25. Pellegrini, M., Bernabei, F., Scorcia, V., & Giannaccare, G. (2020). May home confinement during the COVID-19 outbreak worsen the global burden of myopia?. Graefe's Archive for Clinical and Experimental Ophthalmology, 258, 2069-2070.

26. Sumitha, M., Sanjay, S., Kemmanu, V., Bhanumathi, M. R., & Shetty, R. (2020). Will COVID-19 pandemic-associated lockdown increase myopia in Indian children?. Indian journal of ophthalmology, 68(7), 1496.

27. von Hippel, P. T., & Workman, J. (2016). From kindergarten through second grade, US children's obesity prevalence grows only during summer vacations. Obesity, 24, 2296–2300.

28. Cuschieri, S. (2020). COVID-19 panic, solidarity and equity—the Malta exemplary experience. Journal of Public Health, 1-6.

29. Chinazzi, M., Davis, J. T., Ajelli, M., Gioannini, C., Litvinova, M., Merler, S., ... & Vespignani, A. (2020). The effect of travel restrictions on the spread of the 2019 novel coronavirus (COVID-19) outbreak. Science, 368(6489), 395-400.